



INSTALLATION & OPERATION MANUAL

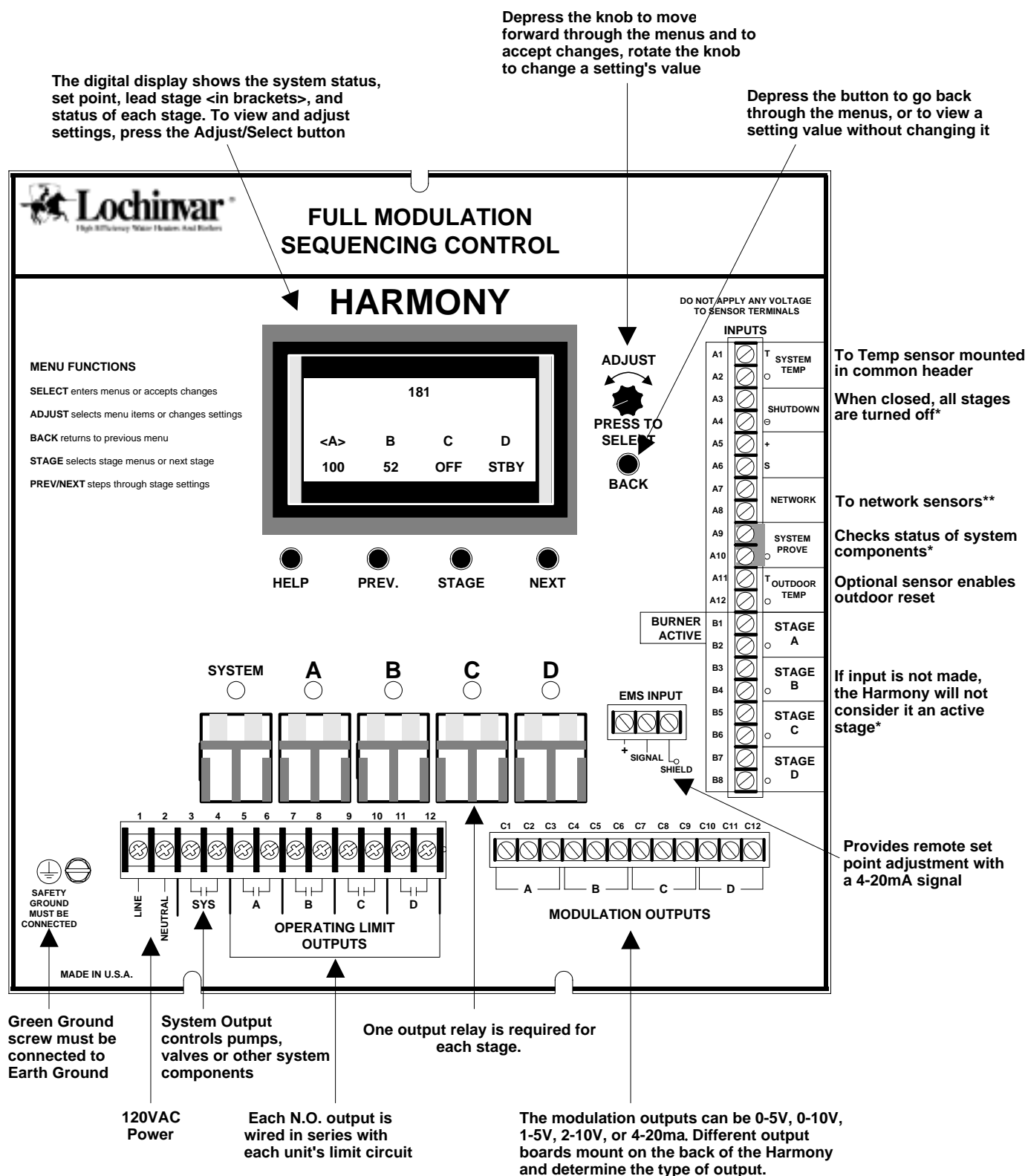
HARMONY

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This manual attempted to be complete and accurate at the time of publication. Additional upgrades and new features may change Harmony functions. Upgrades to this manual may occur at any time. Contact the factory for further details.

Harmony Function Chart



* DRY CONTACTS ONLY

** Only available with the Remote Communications package

Harmony Overview

Sequences up to 4 Fully Modulating Stages

The Harmony is the perfect control whenever multiple fully modulating stages are required. The Harmony controls the on/off and the modulation of each stage to maintain precise set point control.

PID Type Logic

The Harmony's control algorithms allow it to look at the rate of change in the system. If the system temperature is changing quickly, the Harmony will react quickly to adjust the modulating stages' output. If the system temperature changes slowly, the Harmony will make slow and gradual adjustments. Therefore, the Harmony adapts to specific system requirements and minimizes fluctuations around the set point.

Controls 0-5 V, 0-10 V, 1-5V, 2-10V, or 4-20 mA modulating motors

The Harmony is designed to accurately control the output from 0 to 100% of modulation for each of these different types of motors. One Harmony can even control two different types of motors.

Only One Sensor

The Harmony requires only one sensor located in the common output header of all stages.

Digital Display of all System Settings

The Harmony's 80 character alphanumeric digital display names each system parameter in plain English and shows its precise value. The easy to follow menu system allows users to quickly make changes to any system setting without having to learn any specialized codes or keyboard commands. Password protection is available to prevent unauthorized users from making adjustments to control settings.

Automatic Rotation among Stages

Rotating the first stage to be activated on a call for output promotes even wear on each stage. The Harmony has three modes of rotation: Manual, First ON/First OFF, or automatically each time period which can be adjusted from every hour to every 7 days.

Outdoor Reset Control

The Harmony has an optional stand-alone hydronic outdoor temperature reset function.

Connects to Energy Management Systems

The Harmony can accept a 4-20 mA input signal from an EMS to adjust the temperature set point according to outdoor temperature, system requirements, or other factors. In addition, Harmony can be disabled by an Energy Management System (EMS) or other controller when there is no output requirement.

Monitors Stage Status

The Harmony is designed to accept a lockout signal from each stage. If any stage requires a manual reset, the Harmony will automatically skip it when adding more capacity. If a stage goes into lockout during normal operation, the next stage will be activated immediately to maintain the desired output capacity.

System Output is Active when Any Stage is Active

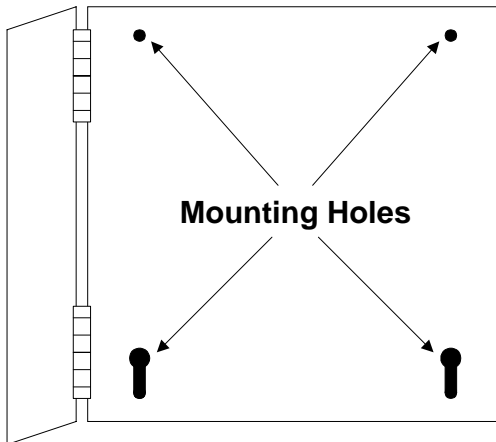
This output can be used to activate a system pump, combustion air damper, or perform any other function that is required when any stage is active. A System Prove input checks the status of components activated by the System output before stages can be activated.

Remote Communication Upgrade Available

The Harmony can be upgraded to the Visual Gold system to monitor and control all Harmony functions from a remote location. The Visual Gold upgrade also allows the Harmony to accept additional sensors, to monitor their status, and to provide alarms if the sensor values are not in the correct range.

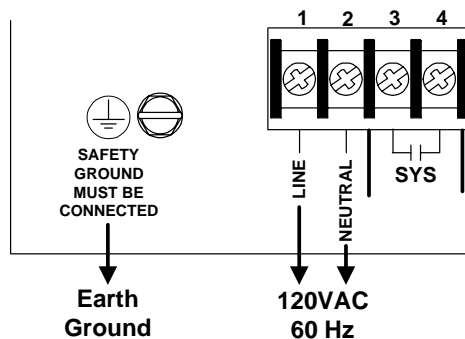
Additional features include: A purge timer, a low fire adjustment, a firing point setting for the next stage based on the firing rate of the current stage, a lag stage timer, a last stage hold adjustment, and many others.

INSTALLATION



MOUNTING THE ENCLOSURE

- Select a location near the equipment to be controlled.
- The surface should be flat, and be sufficiently wide and strong to hold the Harmony.
- Keep the Harmony panel away from extreme heat, cold, or humidity. Ambient operating temperature is from 20 to 120°F.
- Remove the panel from the metal enclosure by removing the top center screw and loosening the two bottom screws. Lift the panel out.
- Screw the enclosure to the surface through the mounting holes in the back of the enclosure.
- Return the panel to the enclosure, replace the top screw, and tighten the bottom two screws.



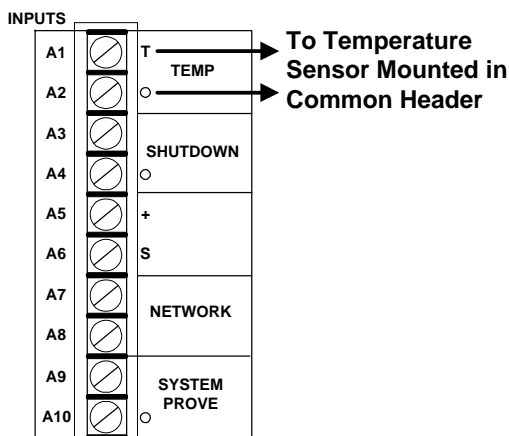
WIRING THE POWER

- Bring the 120VAC 60Hz power wires through a bottom Knockout (KO) of the enclosure. The left front KO is preferred.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- Connect the hot line to terminal marked *LINE*.
- Connect the neutral line to the terminal marked *NEUT*.
- The green ground screw **MUST** be connected to earth ground.

INPUT WIRING

CONNECTING THE SYSTEM SENSOR

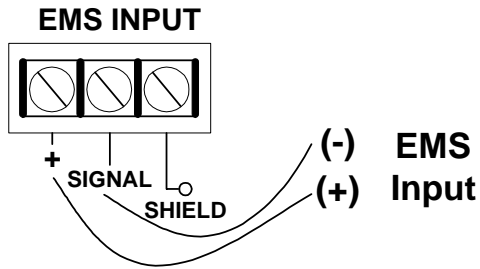
- The Harmony is designed to be connected to a temperature sensor for immersion in a 3/8ID well. Contact the factory for additional temperature sensor options.



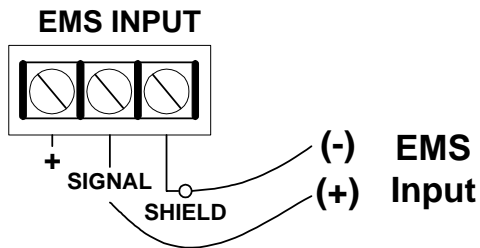
- Locate the sensor in a common header where it will register the output of all the stages in the flow and after all stages have fed the header. If the sensor can not read the output of all the stages, it will not be able to control the system properly.
- Temperature sensor wires can be extended up to 500' by splicing with 18 gauge shielded wire (Belden #8760 or equivalent).
- Do not run sensor wire in conduit with line voltage.
- Temperature sensors have no polarity. Connect the wires from the sensor to the Harmony terminals marked *TEMP- A1, A2*.
- Connect the shield to the circled terminal *TEMP-A2* with one of the sensor wires.

Note: Cut the shield wire at the sensor end.

Harmony Sources Current 24VDC Excitation Voltage

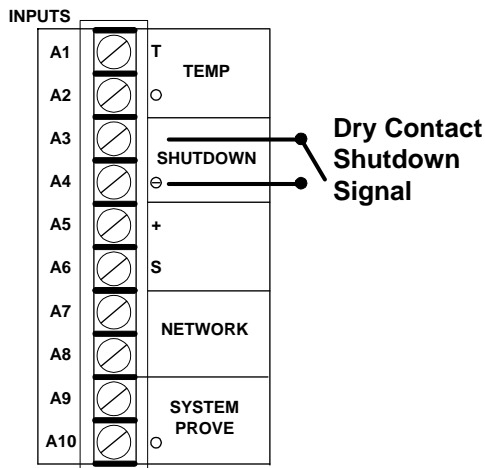


EMS Sourcing Current



CONNECTING AN EXTERNAL SET POINT (4-20mA EMS-CONTROL)

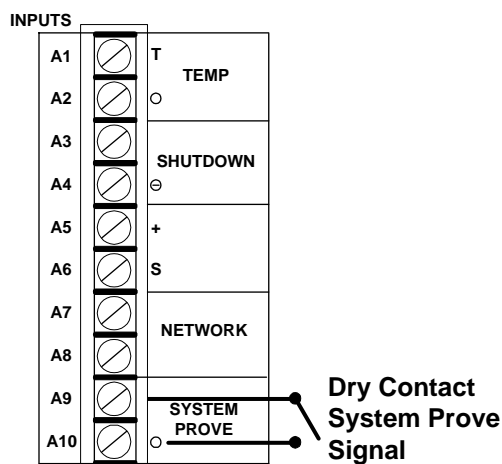
- The Harmony can take a 4-20mA signal from an Energy Management System (EMS) or other signal source to change the set point remotely (see pg. 28 for additional details).
- The signal must be a two-wire 4-20mA.
- A system sensor must be installed as described in the previous section.
- The External Set Point must be set up correctly (see pg. 12). These settings will allow the Harmony to read and monitor the system temperature and also monitor the 4-20mA input to remotely adjust the Harmony set point to the desired value.
- The Harmony can source the current for the 4-20mA input. It provides an excitation voltage of 24VDC. If using the Harmony to source the power, attach the (+) side of the 4-20mA input to the Harmony *EMS* terminal marked +. Attach the (-) side of the 4-20mA signal to the *EMS* terminal marked *SIGNAL*.
- If the EMS or other signal sources the current (provides the excitation voltage), attach the (+) side of the 4-20mA input to the Harmony *EMS* terminal marked *SIGNAL*. Attach the (-) side of the 4-20mA input to the *EMS* terminal marked *SHIELD*.



WIRING THE SHUTDOWN

- This feature can be used whenever it is desirable to turn off the Harmony from a remote location or another controller.
- A typical use for this feature would be to turn off all boiler stages when an EMS panel no longer requires heat in the system.
- When the Shutdown feature is enabled by closing a dry contact, all active stages will immediately modulate down to low. They will remain in low for 45 seconds and then turn off.
- If the System Output relay was active, it will remain active until the System Delay is over, then it will also turn off.
- The Shutdown signal must be a dry contact only. No voltage can be placed across the *SHUTDOWN* terminals.
- Bring the two wires from the dry contact to the terminals marked *SHUTDOWN*- A3, A4.

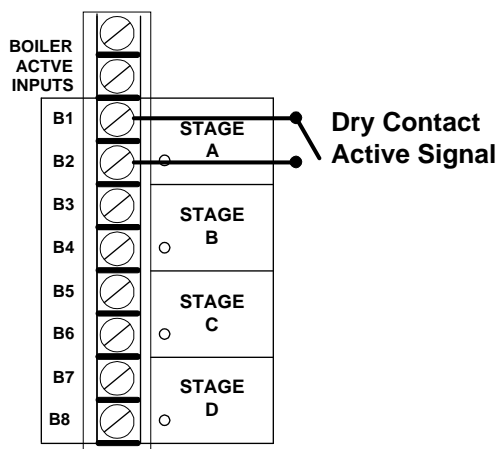
WIRING THE SYSTEM PROVE



WARNING: The **SYSTEM PROVE** input can not be used as a safety limit. All equipment must have its own certified limit and safety controls as required by local codes.

- The System Prove feature is provided to check system component operation.
- A typical use of this feature is to check for flow before firing any boiler stages. When there is a call for heat, the System Output activates the system pump starter. When the pump establishes flow, a flow switch closes together the *SYSTEM PROVE* input. Only then can the Harmony activate boilers and modulate them as required to hold the temperature set point.
- If the *SYSTEM PROVE* input is open on a call, the Harmony will enable only the System Output. All Stage outputs will be off when the *SYSTEM PROVE* input is open.
- A factory installed jumper provides the System Prove signal. Do not remove the jumper unless it will be replaced by a System Prove signal.
- The System Prove signal must be a dry contact only. No voltage can be placed across the *SYSTEM PROVE* - A9, A10 terminals.
- Bring the two wires from the dry contact to the terminals marked *SYSTEM PROVE* - A9, A10.

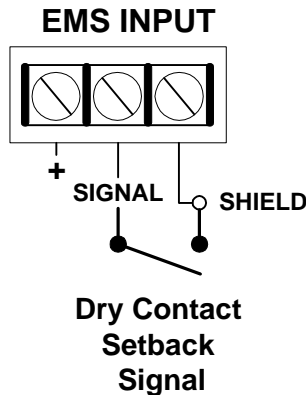
IMPORTANT: Do not remove the factory installed System Prove jumper unless it is replaced by a System Prove signal. If the *SYSTEM PROVE* input is not closed, the Harmony will NOT activate stages.



WARNING: The **BOILER ACTIVE INPUTS** can not be used as a safety limits. All equipment must have its own certified limit and safety controls as required by local codes.

WIRING THE BOILER ACTIVE INPUTS

- A closure across the *BOILER ACTIVE* terminals informs the Harmony that a boiler is running normally. If the *BOILER ACTIVE* terminals open, the Harmony registers that the Stage has encountered a safety limit and can not be restarted without a manual reset. The Harmony will not reactivate or modulate a Stage which is not Active.
- The Boiler Active signal is not a safety, but use of these inputs will significantly improve the Harmony's set point control performance in the event of a Stage encountering a safety limit.
- A pair of *BOILER ACTIVE* terminals is provided for each stage.
- The Boiler Active signal must be a dry contact closure from the boiler controlled by that Stage's output. For example, the Boiler Active signal wired into terminals *STAGE A* (Terminals B1 and B2) must come from the unit whose operating limits are connected to terminals *OPERATING LIMIT OUTPUTS A* (Terminals 5 and 6).
- The *BOILER ACTIVE* terminals are dry contacts only. No voltage can be placed across the them.
- Wire the Boiler Active signals to their respective *STAGE* terminals:
 - *STAGE A* to Boiler Active Input terminals B1&B2
 - *STAGE B* to Boiler Active Input terminals B3&B4
 - *STAGE C* to Boiler Active Input terminals B5&B6
 - *STAGE D* to Boiler Active Input terminals B7&B8



WIRING A SETBACK

- The Setback feature can be used to provide the Harmony with a lower temperature Set Point when less load is required.
- A typical use for Setback is to lower the system temperature during the night or on the weekends when a building is unoccupied, but a minimum level of heat is still required.
- The Setback feature can not be used with External Set Point (4-20mA EMS-control) or Reset operation (see Startup Settings, pg. 11).
- To adjust the amount of Setback see pg. 19.
- The Setback signal is wired into the *EMS* terminals (Terminals *SIGNAL* and *SHIELD*).
- The Setback signal must be a dry contact only. No voltage can be placed across the *EMS SIGNAL* and *SHIELD* terminals.
- When the *EMS SIGNAL* and *SHIELD* are closed, the Setback is enabled and the Harmony will hold the lower Set Point. The lower Set Point will appear on the main display indicating this condition.
- When the closure is removed, the Harmony will revert to the higher saved Set Point.

Note: The Setback is not equivalent to the 4-20mA input, even though both wire into the *EMS* terminals. The 4-20mA input requires a 4-20mA source which changes the Set Point in one degree increments. The Setback provides a single lower Set Point.

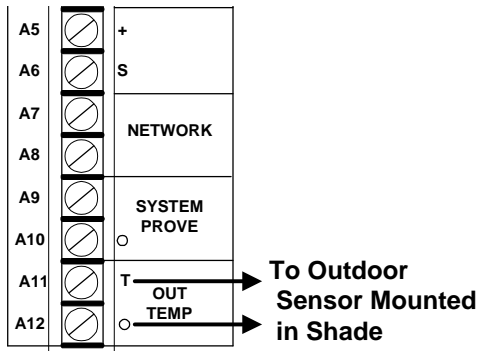
CONNECTING AN OUTDOOR SENSOR

For Reset Operation

- To enable the reset function, see System Startup settings, pg. 11.

For Outdoor Cutoff

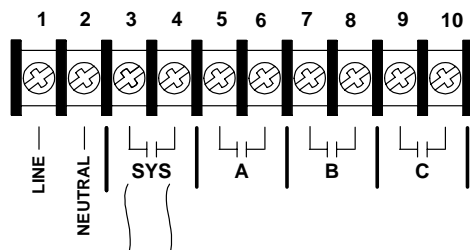
- The Harmony will disable all stages when the outdoor temperature is above the adjustable Outdoor Cutoff temperature.
- This feature will automatically be activated when an outdoor sensor is connected.
- To adjust the Outdoor Cutoff temperature see pg. 26.



Installing the sensor

- For outdoor sensor use the outdoor sensor.
- Locate the sensor in the shade on the north side of the building
- Be sure the location is out of direct sunlight, and away from doors, windows, exhaust fans, vents, or other possible heat sources
- The sensor should be mounted at least 4 inches away from the building wall and approximately 10 feet above ground level
- The sensor wires can be extended up to 500' using shielded 2 conductor cable (Belden #8760 or equivalent).
- Do not run sensor wires in conduit with line voltage wiring.
- Temperature sensors have no polarity. Connect either wire from the outdoor sensor to one of the Harmony terminals marked *OUTDOOR* (Terminals *A11* & *A12*).
- Connect the other sensor wire to the other *OUTDOOR* terminal.
- Connect the shield to the circled terminal *OUTDOOR* (Terminal *A12*) with one of the sensor wires.

OUTPUT WIRING



N.O. contacts to activate a pump, valve or other system component

WIRING THE SYSTEM OUTPUT

System Output Operation in Set Point Mode

- The *SYS* output relay will energize whenever there is a call for output and the Shutdown feature is not active.
- Until the *SYSTEM PROVE* input is shorted, no Stages will be activated. If a Prove is not required, the factory installed jumper should remain.
- The *SYS* will remain energized while any Stage is active.
- When the last Stage relay turns off, the *SYS* output can remain energized for the period of time set by the System Run-On (see pg. 19)
- A typical use of the *SYS* output is to activate a system pump starter. The pump can run whenever there is a call for heat. When heat is no longer required, the pump will stay active for a few more minutes to remove the residual heat from the boilers.

System Output Operation in Reset Mode

- The *SYS* output relay will energize whenever the outdoor temperature is below the Outdoor Cutoff.
- The *SYS* will remain constantly energized while the outdoor temperature is below the Outdoor Cutoff.
- When the outdoor temperature rises 2°F above the Outdoor Cutoff, the *SYS* output will remain energized for the period of time set by the System Run-On (see pg. 19).

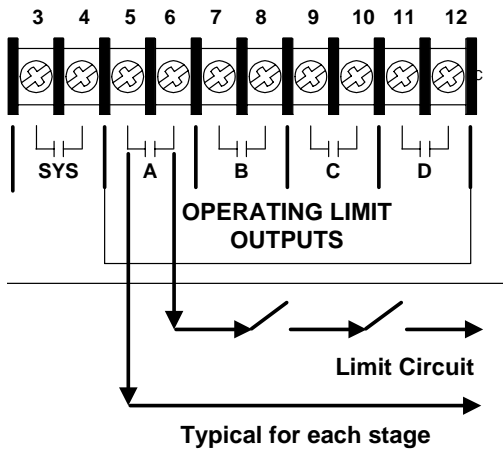
Wiring the *SYS* Output

- The *SYS* output has one Normally Open (N.O.) relay contact.
- The N.O. contacts are dry contacts only. They do not source any voltage.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- Each N.O. contact is capable of switching 6A resistive at 120VAC.
- Total output *SYS* and the *OPERATING LIMIT OUTPUTS* must not exceed 15A.

WIRING THE STAGE OUTPUTS

Installing the Output Relays

- Each output stage (*A* through *D*) which is to be used must have a relay installed in the socket.
The *SYS* relay is included with the Harmony.
- To install a relay, orient the pins and then press it gently into the appropriate socket.
- Any stage output which does not have a relay must have its Mode set to *Off* (see Stage Settings pg. 22).

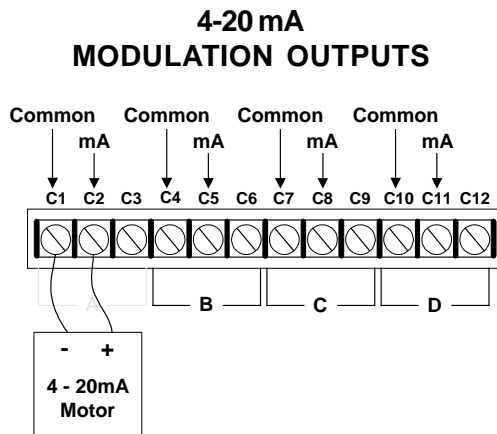


Wiring the Stage Outputs

- Each Stage output (*A* through *D*) has one Normally Open (N.O.) relay contact.
- The N.O. contacts are dry contacts only. They do not source any voltage.
- Each N.O. contact is capable of switching 6A resistive at 120VAC.
- Total output of all stages, including the *SYS*, must not exceed 15A.
- Wire the N.O. relay contacts in series with the boiler's limit circuit.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.

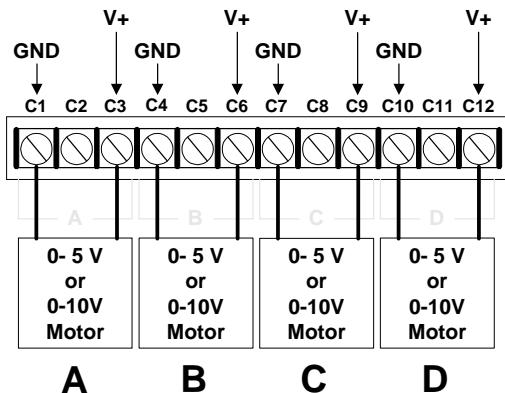
WIRING TO 4-20 MA MODULATING MOTORS

- The Harmony can be equipped to operate up to four 4-20 mA modulating motors.
- To program the control for 4-20 mA output, see System Startup settings, pg. 12.
- Apply the supplied label marked 4-20 mA below the output terminals.
- The output boards are connected on the rear of the panel.
- The pair of outputs *A* and *B* are controlled by a one output board. The pair of outputs *C* and *D* are controlled by a second output board.
- The Harmony sources 24VDC excitation voltage for the 4-20mA signal.
- Wire as shown below:



		Common	mA Source (+)
Harmony Sources Current	Stage A	C1	C2
	Stage B	C4	C5
	Stage C	C7	C8
	Stage D	C10	C11

Voltage MODULATION OUTPUTS

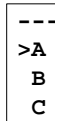


WIRING TO VOLTAGE MODULATING MOTORS

- The Harmony can be equipped to operate up to four 0-5 V, 0-10V, 1-5V, or 2-10V modulating motors.
- Apply the supplied label marked Voltage below the output terminals.
- The output boards are connected on the rear of the panel.
- To select the range, 0-5V, 0-10V, 1-5V or 1-10V, see pg. 12.
- The pair of outputs *A* and *B* are controlled by a one output board. The pair of outputs *C* and *D* are controlled by another output board.
- Wire as shown below:

	GND	V+
Stage A	C1	C3
Stage B	C4	C6
Stage C	C7	C9
Stage D	C10	C12

MAKING SELECTIONS



This pointer shows the currently selected item



The **BACK** button returns to a previous menu without changing the selection



Pressing

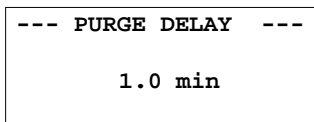
The **ADJUST/SELECT** knob saves the selection to memory and returns to a previous menu



Rotating

The **ADJUST/SELECT** knob moves the pointer up and down selections

Example: CHANGING VALUES



The *Purge Delay* is currently 1 minute

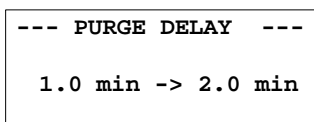


The **BACK** button returns to a previous menu without changing the value



Rotating

The **ADJUST/SELECT** knob changes the value - this is indicated by a pointer from the old value to a new value



The screen shows the old and new value



Pressing

The **ADJUST/SELECT** knob saves the new value (2.0 min) to memory and returns to a previous menu



The **BACK** button returns to a previous menu without changing the value

USING THE MENUS

MENU TYPES

System Startup Settings - determines the type of system. For example, the system is a hot water heating system with 0-10V modulating motors. If the Startup Settings are not correct, the Harmony can not operate the system correctly.

Set Point/Gain/Lead Stage Settings - These settings might need occasional adjustment by operating personnel. These are the only settings which may require changes after the Harmony has been successfully initialized for your specific type of system.

Stage Settings - determine how the individual Stage outputs are controlled. When installing the panel, each Stage must be set correctly, or the Harmony either will not control the Stage or will control them erratically.

System Settings - determine how the system will operate. These are general settings which affect all Stages. The default settings will generally work in most applications, but adjustments should be made to fine-tune the performance of your system.

MENU BASICS

- The menus are in English and will guide you through the settings.
- To change a selection, rotate the black knob marked **ADJUST** and **PRESS TO SELECT** (**ADJUST/SELECT**). Rotating the knob clockwise will move down the list of possible selections. Rotating the knob counterclockwise will move up the list.
- A pointer in front of a menu line indicates that it is the one currently selected.
- When the pointer is on the same line as the item to be selected, press the black **ADJUST/SELECT** knob. This will either save the selection, or bring up a new screen to make further changes to that menu item.
- The **BACK** button will return you to the previous screen without saving any changes made.

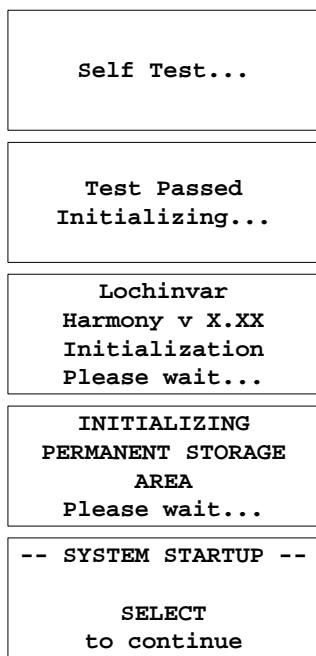
CHANGING SETTINGS

- Some settings require a number, such as time or temperature to be adjusted.
- These screens will be indicated with the title on top and then the current numerical value for that setting.
- To change a selection, rotate the **ADJUST/SELECT** knob. Rotating the knob will cause a pointer to appear. Both the old and new value will be displayed.
- The **BACK** button will return you to the previous screen without saving any changes made.
- When the new value (the one being pointed to) is correct, press the **ADJUST/SELECT** knob. This will save the selection to memory and return you to the previous menu.

SYSTEM STARTUP

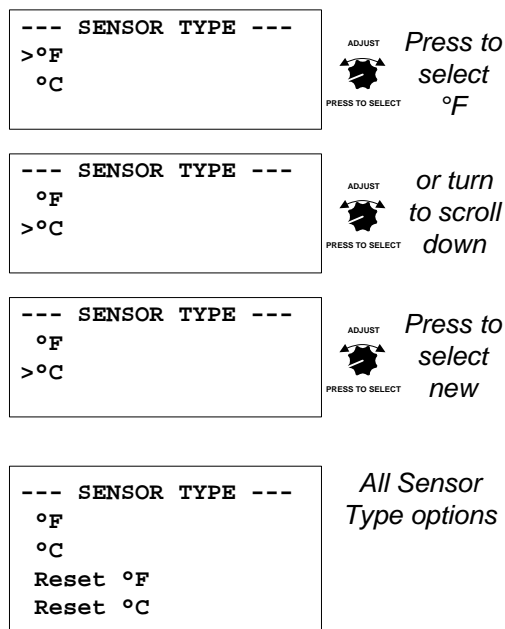
STARTUP SEQUENCE

- The series of initialization screens appears on the left. The Harmony will automatically step through the screens.
- When powered, the Harmony performs a self test on its components.
- After the self test diagnostics have been successfully completed, the Harmony will initialize the panel.
- On the first powerup, the *System Startup* screen will appear after the initialization is complete. If it doesn't, the Harmony has already been configured. To check the configuration, or to make changes, follow the procedure on pg. 28 to bring up the System Startup screens.
- The System Startup menu determines the sensors, the type of output, the operating mode, and the modulating mode.
- Press the *ADJUST/SELECT* knob once to begin setting up the panel.



SELECTING THE SENSOR TYPE

Check the installation and which sensor was installed



Temperature Set Point Mode

Default - °F

- The same temperature sensor can display either in °F or °C.
- If °F is selected, all temperatures and settings will be displayed in degrees Fahrenheit.
- If °C is selected, all temperatures and settings will be displayed in degrees Celsius.

Reset Mode (Reset °F or Reset °C)

- Reset mode is only available if an outdoor sensor is connected to terminals *A11* and *A12*. **DO NOT** select *Reset °F* or *Reset °C* without an outdoor sensor.
- The same outdoor sensor can display either in °F or °C.
- If *Reset °F* is selected, all temperatures and settings will be displayed in degrees Fahrenheit.
- If *Reset °C* is selected, all temperatures and settings will be displayed in degrees Celsius.
- For information on how to configure the Reset, see pg. 25.

```

---- EMS INPUT ----
>Setback
EMS-Control
  
```

ADJUST  Press to select
PRESS TO SELECT Setback

```

---- EMS INPUT ----
>Setback
EMS-Control
  
```

ADJUST  or turn
PRESS TO SELECT to scroll down

```

---- EMS INPUT ----
Setback
>EMS-Control
  
```

ADJUST  Press to select
PRESS TO SELECT EMS

IMPORTANT: Do not select *EMS-Control* unless an appropriately configured signal from an EMS system is correctly wired into the Harmony. For additional details, see pg. 5 for wiring, and pg. 28 for EMS-Control setup.


```

- OUTPUT TYPE A&B -
>4-20ma
0-10v
0-5v
  
```

ADJUST  Press to select
PRESS TO SELECT 4-20ma

```

- OUTPUT TYPE A&B -
4-20ma
>0-10v
0-5v
  
```

ADJUST  or turn
PRESS TO SELECT to scroll down

```

- OUTPUT TYPE A&B -
4-20ma
>0-10v
0-5v
  
```

ADJUST  Press to select
PRESS TO SELECT new

```

- OUTPUT TYPE C&D -
>4-20ma
0-10v
0-5v
  
```

Repeat
process for
Stages C&D

EMS INPUT

Default - Setback

Not available for Reset Sensor Types

Setback

- This default setting allows the Set Point to be adjusted either manually at the panel, or by a Visual Gold upgrade for remote communications.
- If desired, a dry contact switch can be wired across the *EMS INPUT* terminals *SIGNAL* and *SHIELD* to allow the panel to hold a lower temperature Set Point when less load is required. To adjust the amount of Setback, see pg. 19.
- When selecting *Setback*, there is no requirement for any wiring across the *EMS INPUT* terminals. **DO NOT** select *EMS-Control* unless your system meets the requirements below.

External Set Point (4-20mA EMS-Control)

- For this option, an EMS system must provide a 4-20mA signal to automatically change the Set Point based on pre-programmed system parameters.
- An active signal must be wired into the *EMS* Harmony terminals. If the Harmony does not receive a signal between 3.9mA and 20.1mA, it will **NOT** activate any stages.
- If your system meets the above two criteria, see pg. 28 to complete the EMS-control setup.

SELECTING THE OUTPUT TYPE

- The Harmony has two output cards, one for stages A & B, and one for stages C & D.
- Both output cards must be programmed for the appropriate mode of operation.
- Outputs can be configured for 4-20mA operation (current) or the voltage range can be selected (0-5V, 0-10V, 1-5V, 2-10V).
- Check the modulating motor to determine its control requirements.
- Select the appropriate *Output Type* for stages A & B. The Harmony will then automatically bring up the screen for stages C & D.
- Select the appropriate *Output Type* for stages C & D.
- If different types of burners are being used, stages C & D can be selected to have a different Output Type than stages A & B.

SELECTING THE MODULATING MODE

Default - Normal


```

- MODULATING MODE
>NORMAL
PARALLEL
  
```

ADJUST  Press to select
PRESS TO SELECT Normal

```

- MODULATING MODE
NORMAL
>PARALLEL
  
```

ADJUST  or turn
PRESS TO SELECT to scroll down

```

- MODULATING MODE
NORMAL
>PARALLEL
  
```

ADJUST  Press to select
PRESS TO SELECT Parallel

- Most boilers run more efficiently as their modulation increases. Therefore, for most systems, it is more energy efficient to run one boiler in high than several boilers at lower modulation. If your system is of this type, select *Normal*.
- There are some systems where it may be more energy efficient to run several units at lower modulation than one at high. If that is the case select *Parallel*.

```
-- OPERATING MODE --
>NORMAL
PROCESS
```

ADJUST  Press to
PRESS TO SELECT select
Normal

```
-- OPERATING MODE --
NORMAL
>PROCESS
```

ADJUST  or turn
PRESS TO SELECT to scroll
down

```
-- OPERATING MODE --
NORMAL
>PROCESS
```

ADJUST  Press to
PRESS TO SELECT select
Process

SELECTING THE OPERATING MODE

Default - Normal

- Most heating applications do not experience rapid changes in system temperature. For these systems, it is best to adjust the modulation based on the rate of system rise or fall. This PID type of algorithm will help to prevent short cycling of the stages, reduce thermal stress on the system, and maintain an accurate system temperature. If your equipment is of this type, select *Normal*.
- Systems that run for process may experience large changes in load almost instantaneously. In *Process* mode, the Harmony will react immediately to load changes. Large load changes may cause stages to be short cycled, as the Harmony can enable and disable stages within seconds.

After making this selection, the main display screen will be displayed.

OPERATING SETTINGS

CHANGE SET POINT, GAIN, LEAD STAGE

Temperature				
<A>	B	C	D	
OFF	OFF	OFF	OFF	

---	SETTINGS	---
>	Set Point	
	Gain	
	Lead Stage	



Press to
show
Settings

---	SET POINT	---
	Value	



Press to
show
Set Point

---	SET POINT	---
	Value -> New Value	



Turn to
adjust
value

---	SET POINT	---
	Value -> New Value	



If the optional Outdoor Sensor
is installed

--	OUTDOOR CUTOFF	--
	Value -> New Value	



Turn to
adjust
value

--	OUTDOOR CUTOFF	--
	Value -> New Value	



Press to
select
new

THE MAIN DISPLAY

- The main display screen may have different values in the top two lines depending on the application.
- The third line shows the four stages. The Lead Stage will be in brackets. For example, the Lead Stage shown at left is <A>.
- The last line shows the status of each stage. The stages may be *Off* or the actual percent modulation will be displayed.
- To reach the Settings menu, press the *ADJUST/SELECT* knob and release it.

SET POINT

SET POINT DISPLAY

- The Set Point is the temperature value the Harmony will use to control the system.
- The Harmony will either increase the amount of modulation, decrease the amount of modulation, or maintain the same amount of modulation to maintain the system temperature around the Set Point.
- The Set Point is the target temperature the Harmony will maintain. The system can be expected to fluctuate above and below the Set Point. The size of the fluctuation depends on the number of stages, the system load, and the Operating Mode selected (see pg. 13).

Outdoor Cutoff Temperature

- If the outdoor sensor is installed (see pg. 7), the *Outdoor Cutoff* screen will automatically appear after the Set Point has been selected.
- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the Harmony will control and modulate stages to hold the temperature Set Point.
- When the outdoor temperature rises to the Outdoor Cutoff temperature plus a 2°F differential, the Harmony will disable the system.

RESET °F AND RESET °C

- The Set Point is based on the Reset Ratio, Offset, and Outdoor Cutoff. To make these settings, see pg. 25.

EXTERNAL SET POINT (4-20mA EMS- CONTROL)

- The Set Point value can only be changed by adjusting the 4-20mA input wired into the Harmony, see pg. 28.
- Rotating the *ADJUST/SELECT* button will have no impact on the Set Point value.

```

--- SETTINGS ---
Set Point
>Gain
Lead Stage
  
```

ADJUST  Press to show setting

```

--- GAIN ---
Value -> New Value
  
```

ADJUST  Turn to adjust value

```

--- GAIN ---
Value -> New Value
  
```

ADJUST  Press to select new

GAIN/THROTTLE

OPERATING MODE - NORMAL

Default = 0

- The Gain adjusts the PID logic in the Harmony to control how much modulation is changed when the system temperature is different from the Set Point.
- A Gain of 0 is a good starting point for all systems.
- If, during normal load conditions, the system temperature tends to fluctuate significantly above and below the Set Point, decrease the Gain by two numbers (for example, from 0 to -2). Wait for at least 15 minutes before evaluating how the change has affected the system.
- If, during normal load conditions the system temperature tends to remain consistently below the Set Point (or consistently above the Set Point), increase the Gain by two numbers (for example, from 0 to 2). Wait for at least 15 minutes before evaluating how the change has affected the system.

OPERATING MODE - PROCESS

Default = 1.0

- The Gain acts as a throttling range around the Set Point.
- When the actual temperature is equal to the Set Point, the lead stage will be at 100% modulation.
- Each throttling range above or below the Set Point controls one stages modulation linearly from 0 to 100%.
- The Process Gain Table below shows the relationship between the Gain and stage modulation.
- The Process Gain Table does not show all the possible modulation values. The table is for example only. The Harmony will control the modulation in one percent increments based on the Set Point and Gain value.

PROCESS GAIN/THROTTLING RANGE TABLE

SYSTEM TEMPERATURE	STAGES MODULATION
3 x Gain Setting Above Set Point	All Stages OFF
2.5 x Gain Setting Above Set Point	All Stages OFF
2 x Gain Above Set Point	Lead Stage at 0%
1 x Gain Above Set Point	Lead Stage at 0%
0.5 x Gain Above Set Point	Lead Stage at 50%
At Set Point	Lead Stage at 100%
0.5 x Gain Below Set Point	Lead Stage at 100%, 1 Lag at 50%
1x Gain Below Set Point	Lead and 1 Lag at 100%
2 x Gain Below Set Point	Lead and 2 Lag at 100%
2.5 x Gain Below Set Point	Lead and 2 Lag at 100%
3 x Gain Below Set Point	All Stages at 100%

```

--- SETTINGS ---
Gain
>Lead Stage
<Stage Settings>
  
```



*Press to
show
setting*

```

--- LEAD STAGE ---
>A
B
C
  
```



*Turn to
adjust
value*

```

--- LEAD STAGE ---
A
>B
C
  
```



*Press to
select
new*

LEAD STAGE

Used to manually change the lead stage

- The Lead Stage is the first stage brought on when output is required.
- The Lead Stage can be rotated manually or automatically. The automatic rotation is recommended (see pg. 17).
- The current Lead Stage is shown in brackets on the main display.
- Only Stages which are set to Auto Mode can be Lead. Therefore, not all the stages may be available when manually selecting a new Lead Stage.

SYSTEM SETTINGS

THE SYSTEM SETTINGS MENU

- These are general settings which affect all Stages and overall operation.
- The Harmony will generally operate satisfactorily with the default settings. However, it is recommended that each of these settings be checked on Startup to tune the Harmony to the particular system.
- From the main display, press the *ADJUST/SELECT* knob and release it to reach the *Settings* display.
- Scroll down to *<System Settings>* and select it.
- The *System Settings 1* menu will be shown.

SYSTEM SETTINGS 1

Temp

<A>	B	C	D
OFF	OFF	OFF	OFF

--- SETTINGS ---
>Set Point
Gain
Lead Stage



Press to
show
Settings

--- SETTINGS ---
Gain
Lead Stage
><System Settings>



Turn to
scroll
down

- SYSTEM SETTINGS 1-
>Auto Rotate
Purge Delay
Lag Delay



Press
for
menu

- SYSTEM SETTINGS 1-
>Auto Rotate
Purge Delay
Lag Delay



Press to
show
setting

- LEAD AUTO ROTATE -
>Manual
Time
Lst on



Turn to
scroll
down

--- LEAD STAGE ---
Manual
>Time
Lst on



Press to
select
new

AUTO ROTATE

Default - Time

- The Lead Stage will always be the first stage activated when there is a call for output.
- Automatically rotating the Lead among the active stages promotes more even wear on the Stages and can help prolong the life of each unit.
- The Lead Stage is shown on the main display in brackets.
- The Harmony has three selections for rotating the Lead Stage. Each is described below.

Manual

- If *Manual* is selected, the Lead Stage will not automatically rotate.
- In Manual, whichever stage is presently the Lead Stage will remain the Lead Stage until there is a power failure. Then the Harmony will revert back to the lowest Stage in Auto Mode (that is, A first, then B, C, or D).

Time

- On power up, or any time the Harmony loses power, the Lead Stage will be the lowest stage in Auto Mode (that is, A first, then B, C, or D).
- If the default 24 hour rotation is used, at 2 am every morning, the Lead Stage will change to the next stage in Auto Mode. Note: If you do not set the system time (see pg. 21), the Harmony will assume it was installed at 2 pm.
- If the Rotate Time is changed (see pg. 20), the Lead Stage will change to the next stage in Auto Mode every time the Rotate Time has elapsed. For example, with a 12 hour Rotate Time, the Lead Stage will rotate from A to B after the first 12 hours of operation, and then from B to C after the next 12 hours, and so on.
- The Lead Stage will always be the first stage brought on and modulated when there is a call for output. As more output is needed, additional Stages are added.
- When less output is needed, the additional Stages are turned off in the reverse order of how they were added. For instance, if the stages were added in the sequence A, B, and C, then they will be turned off in the sequence C, B, and finally A.

- SYSTEM SETTINGS 1-
Auto Rotate
>Purge Delay
Lag Delay



Press to
show
setting

--- PURGE DELAY ---
Value -> New Value



Turn to
adjust
value

--- PURGE DELAY ---
Value -> New Value



Press to
select
new

- SYSTEM SETTINGS 1-
Purge Delay
>Lag Delay
Standby Time



Press to
show
setting

--- LAG DELAY ---
Value -> New Value



Turn to
adjust
value

--- LAG DELAY ---
Value -> New Value



Press to
select
new

Lst on

- On power up, or any time the Harmony loses power, the Lead Stage will be the lowest stage in Auto Mode (that is, A first, then B, C, or D).
- The Lead Stage will always be the first stage brought on and modulated when there is a call for output. As more output is needed, additional stages are added.
- When less output is needed, the Lead Stage will be the first stage turned off. The bracket indicating lead stage will then switch to the next available stage in Auto Mode. For instance, if the stages were added in the sequence A, B, and C, then they will be turned off in the sequence A, B, and finally C. The lead stage will now be D when more output is needed.

PURGE DELAY

Default - 1.0 min

- Most fully modulating units must go through a purge cycle before they are brought on line and can begin generating heating.
- After activating a new Stage, the Harmony does not adjust its modulation until the Purge Delay is over. This allows the unit to fully come on line and to begin producing output. Once the Purge Delay is over, the Harmony can begin adjusting its modulation to hold the set point.
- The Purge Delay helps to prevent short cycling of a newly activated Stage. Once a Stage is activated, it **MUST** run through the entire Purge Delay period.
- The minimum Purge Delay setting **MUST** be the time required for the unit's purge cycle.
- The actual Purge Delay should be set to the amount of time between when a Stage is activated, and when the Harmony sensor begins to see a change in output. This can be several minutes longer than the actual purge time of the unit.

LAG DELAY

Default - 0 min

- Set the Lag Delay to 0 min when two or more Stages will generally be needed to hold the load.
- The Lag Delay requires the previous stage to remain at 100% modulation for the full period of the Lag Delay before another Stage can be activated. For example, if the Lag Delay is set to 10 minutes, the Lead Stage would need to remain at 100% modulation for a full ten minutes (never backing down to even 99%) before a lag stage could be activated.
- The Lag Delay is useful in installations where one unit should usually have enough output to hold the load unless it fails or load conditions become extreme.
- The Lag Delay overrides the value of the Modulation Point selected for each stage. Regardless of that setting, the previous stage must reach 100% and stay there before another Stage can be activated.
- The full Lag Delay must always elapse regardless of what happens to system temperature. Therefore, set the Lag Delay to 0 min if you want smooth set point control from multiple units.

- SYSTEM SETTINGS 1-
Lag Delay
>Standby Time
System RunOn



Press to
show
setting

-- STANDBY DELAY --

Value -> New Value



Turn to
adjust
value

-- STANDBY DELAY --

Value -> New Value



Press to
select
new

- SYSTEM SETTINGS 1-
Standby Time
>System RunOn
<More Settings>



Press to
show
setting

-- SYSTEM RUN-ON --

Value -> New Value



Turn to
adjust
value

-- SYSTEM RUN-ON --

Value -> New Value



Press to
select
new

- SYSTEM SETTINGS 1-
Standby Time
System RunOn
><More Settings>



Press to
show
more

- SYSTEM SETTINGS 2-
>Setback
Rotate Time
Last Stg Hold



Press to
show
setting

--- SETBACK ---

Value -> New Value



Turn to
adjust
value

--- SETBACK ---

Value -> New Value



Press to
select
new

STANDBY TIME

Default - 10 min

- The Standby Time only applies to Stages in Standby Mode.
- A Standby Stage can only be activated after all the Stages in Auto Mode have run at 100% modulation for the full Standby Time.
- Standby Stages are used for backup up or extreme load conditions only. A Standby Stage can never be a Lead Stage
- The full Standby Time must always elapse regardless of what happens to system temperature. Therefore, shorter Standby Times will result in smoother set point operation in extreme conditions. Longer Standby Times will result in more loss of load, but may prevent a Standby Stage from firing if the other stages can eventually meet the load, or if the load decreases.

SYSTEM RUN-ON

Default - 0 min

- The SYS output relay will energize whenever there is a call for output and the Shutdown feature is not active.
- The SYS will remain energized while any Stage is active. When the last Stage relay turns off, the SYS output will remain energized for the period of time set by the System Run-On.
- If the System Run-On is set to 0, the SYS output will turn off immediately when the last Stage turns off.
- A common use of the SYS output is to control a system pump in a heating system. After the last Stage is turned off, it is often desirable to run the system pump for an additional period of time to transfer the residual heat from the boilers to the heating system.

SYSTEM SETTINGS 2

SETBACK

Default - 0

- Setback is not available in the Reset, or 4-20mA EMS-Control mode.
- The Setback feature can be used to provide the Harmony with a lower temperature Set Point when less load is required.
- The lower Set Point will appear on the main display indicating this condition.
- A typical use for Setback is to provide a lower system temperature to a factory during the night or on the weekends when product is not being manufactured but heat is still required.
- The Setback will not be activated unless a signal is wired into the Harmony EMS terminals. See pg. 7 for wiring.
- The amount of Setback selected is subtracted from the Set Point when a Setback signal is received.
- For a example, if the Set Point is 180°F and the Setback is 20°F, then when the EMS SIGNAL and SHIELD terminals are closed, the Harmony will hold a Set Point of 160°F.

- SYSTEM SETTINGS 2-
Setback
>Rotate Time
Last Stg Hold



Press to
show
setting

-AUTO ROTATE PERIOD-
Value -> New Value



Turn to
adjust
value

-AUTO ROTATE PERIOD-
Value -> New Value



Press to
select
new

- SYSTEM SETTINGS 2-
Rotate Time
>Lst Stg Hold
Password



Press to
show
setting

- LAST STAGE HOLD -
Value -> New Value



Turn to
adjust
value

- LAST STAGE HOLD -
Value -> New Value



Press to
select
new

IMPORTANT: The temperature limits set on the boilers must be higher than the Harmony Set Point. Read the section at right for details that will prevent erratic system operation.

ROTATE TIME

Default 24hr

- The Rotate Time only takes effect if the Auto Rotate type is Time (see pg. 17).
- The default value is 24 hours and is appropriate for most systems. With 24 hour rotation, at 2 am every morning, the Lead Stage will change to the next stage in Auto Mode. *Note:* If you do not set the system time (see pg. 21), the Harmony will assume it was installed at 2 pm.
- The Rotate Time is adjustable in one hour increments from 1 hour to 168 hours (7 days).
- If the Rotate Time is not 24, the Lead Stage will change to the next stage in Auto Mode every time the Rotate Time has elapsed. For example, with a 12 hour Rotate Time, the Lead Stage will rotate from A to B after the first 12 hours of operation, and then from B to C after the next 12 hours, and so on.

LAST STAGE HOLD

Default 0

- The Last Stage Hold prevents short cycling of the Lead Stage during low load conditions.
- Even at 1% modulation, most fully modulating units are outputting at least 20% of their maximum output. Some units may be outputting significantly more.
- In low load conditions, the system might require only 5% of the output of one Stage. When the Harmony brings on the Lead Stage, this is 20% of the output. The Set Point is quickly exceeded, and the Harmony turns the Lead Stage off.
- To prolong the run time during this type of condition, use the Last Stage Hold setting.
- The Harmony will allow the system temperature to exceed the Set Point by the number of degrees selected, before the Lead Stage is turned off.
- For example, with a Set Point of 160°F and a Last Stage Hold setting of 20°F, the Lead Stage boiler will remain on, at low modulation, until the Set Point reaches 180°F.

Avoiding Conflicting Boiler Limits

- The temperature limits set on the boilers **MUST** be set considerably higher than the Harmony's Set Point for the reasons detailed below.
- The Harmony sensor is located in a common header some distance from the boilers.
- As the water enters the header and travels to the sensor location, energy is dissipated.
- Therefore, the temperature in the header will correctly be lower than that registered by sensors in the boilers.
- In addition to the normal drop experienced between the boiler's internal reading and that read by the Harmony sensor, the Last Stage Hold setting must be accounted for. The boiler limit must be set above the Set Point **PLUS** the Last Stage Hold **PLUS** the normal drop experienced in the piping.
- Using the previous example of a Harmony Last Stage Hold with a 20°F Set Point, the boilers' limits must be set enough over 180°F to prevent the boilers' internal limits being reached. In this situation, the boiler high limit should be set at approximately 195°F to prevent the difference in boiler temperature vs. header temperature causing erratic operation.

<div> <div>---</div> <div>LOGIN</div> <div>Enter password:</div> <div>M***</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Turn to adjust Letter 1</div>
<div> <div>---</div> <div>LOGIN</div> <div>Enter password:</div> <div>M***</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Press to select Letter 1</div>
<div> <div>---</div> <div>LOGIN</div> <div>Enter password:</div> <div>MM**</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Turn to adjust Letter 2</div>
<hr/>		
<div> <div>CHANGE PASSWORD?</div> <div>No</div> <div>>Yes</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Press to select Yes</div>
<div> <div>--</div> <div>NEW PASSWORD</div> <div>Enter password:</div> <div>M***</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Turn to adjust Letter</div>
<div> <div>---</div> <div>LOGIN</div> <div>Enter password:</div> <div>M***</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Press to select Letter</div>
<div>After setting all letters</div>		
<div> <div>--</div> <div>NEW PASSWORD</div> <div>RE-enter password</div> <div>M***</div> </div>		
<div>After setting all letters</div>		
<div> <div>-- !! SUCCESS !! --</div> <div>Password changed!</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Press to finish</div>
<hr/>		
<div> <div>- SET PRESENT TIME -</div> <div>2:00pm</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Turn to adjust hour</div>
<div> <div>- SET PRESENT TIME -</div> <div>11:**am</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Press to select hour</div>
<div> <div>- SET PRESENT TIME -</div> <div>11:00am</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Turn to adjust minutes</div>
<div> <div>- SET PRESENT TIME -</div> <div>11:45am</div> </div>	<div> <div>ADJUST</div> <div></div> <div>PRESS TO SELECT</div> </div>	<div>Press to select minutes</div>

PASSWORD

Default Disabled

- The Password is provided to prevent unauthorized users from making changes to the Harmony settings.
- Setting up the Password feature is not recommended as it slows down access, makes servicing more difficult, and can disable the system if management or ownership should change.
- The Password feature is not active unless a user enables it.
- If you choose to enable the Password, **DO NOT** forget the Password. Write it down and store it in a safe location known to at least one other authorized user.
- When the Password is enabled, none of the settings can be changed without entering the Password.
- Once the Password is entered, you can make multiple changes. The Password will expire 15 minutes after the last change has been made.

Using the Default Password

- The Harmony has a built in default Password - MMOD.
- Enabling the default Password will prevent most unauthorized users from adjusting the settings, but will not prevent Lochinvar service personnel, or anyone else with access to this manual, from adjusting the panel.
- To enable the default Password, enter the *System Settings 2* menu, select *Password*, and follow the prompts to enable the Password.
- At the Login screen, you will have to enter the Password. Turn the *ADJUST/SELECT* knob until the desired letter is shown. Then select the letter to move on.
- Enter *MMOD* into the Login screen as shown top left.
- When completed, select *No* to the prompt *Change Password?*

Changing the Password

- Follow the instructions to use the default Password, but select *Yes* to the prompt *Change Password?*
- Enter your new Password in the *New Password* screen. Turn the *ADJUST/SELECT* knob until the desired letter is shown. Then select the letter to move on.
- Reenter the same new password when prompted.
- If the password is correctly entered, the *Success* screen will appear. If you made a mistake, the procedure will need to be repeated.

SET TIME

- Setting the system time will set the default 24 hour rotation to occur at 2 am every morning.
- To set the Time, enter the *System Settings 2* menu, select *Set Time*.
- Turn the *ADJUST/SELECT* knob until the correct hour is shown. Be sure that *am* or *pm* is set correctly. Then select the hour.
- Turn the *ADJUST/SELECT* knob until the correct number of minutes is shown. Then select the minutes.

Temp			
<A>	B	C	D
OFF	OFF	OFF	OFF

Press  STAGE

- STAGE A SETTINGS -
>Mode
Ignition %
Mod Start %

After completing all settings for Stage A -
Select Stages B, C, and D

Press  STAGE

- STAGE B SETTINGS -
>Mode
Ignition %
Mod Start %

IMPORTANT: When initializing the panel,
the **MODE** for all four Stages
MUST BE SET


- STAGE SETTINGS -
>Mode
Ignition %
Mod Start %

 *Press to show Mode*

--- STAGE MODE ---
Manual
>Off
On

 *Press to select Off*

--- STAGE MODE ---
>Auto
Standby
Manual

 *or turn to scroll down*

--- STAGE MODE ---
>Auto
Standby
Manual

 *Press to select new*

--- STAGE MODE ---
Auto
Standby
Manual
Off
On

All Mode Options

STAGE SETTINGS

INDIVIDUAL STAGE ADJUSTMENTS

THE STAGE MENU

- In most installations, all Stage adjustments are the same, but each of the four output Stages can be configured differently if desired.
- If the stages are not set up properly, the Harmony operation may appear to be erratic.
- From the main display, press the *STAGE* button and release it.
- The *Stage A Settings* menu will be shown.
- Make all the appropriate settings for Stage A as described below and on the following two pages.
- After completing all the settings for Stage A, you have the option of copying these settings to all other Stages. Everything but the Mode -- *Auto/Standby/Manual/Off/On* -- will be copied.
- Then press the *STAGE* button to bring up the *Stage B Settings* menu and make all the settings. Continue until all four stages have been set.
- To move around the Stage Menus more easily, see pg. 29.

MODE

Default - OFF

Auto/Standby/Manual/Off/On

- The Harmony only controls the modulation of Stages set to Auto or (after a delay) those set to Standby. None of the other settings are recommended for output Stages connected to active units.
- Any Stage without an active unit connected, and/or without an output relay must be set to *Off*.
- The following list describes the *MODE* options:
 - Auto* - The Harmony will control the Stage's operation to maintain the Set Point. Only Stages set to *Auto* can be Lead Stages.
 - Standby* - Standby Stages can only be activated when all Stages in *Auto* have been at 100% modulation for a selectable period of time (see pg. 14). Standby is generally used when an older or less efficient unit is available, but is not desired to run except under extreme load conditions. A Standby Stage **CAN NOT** be a Lead Stage.
 - Manual* - The Manual Mode should only be used when testing a Stage. Manual overrides the System Prove input (see pg. 6). The exact percent of modulation for a Stage can be set with the Manual mode. Once selected, the unit will immediately turn on and be modulated to the selected percentage.
 - Off* - Any output Stage A through D without a relay, or not connected to a physical unit should be set to *Off*. The Off Mode can also be used to disable units which are being serviced.
 - On* - The On Mode should only be used when testing a Stage. The On Mode overrides the System Prove input (see pg. 6). Once selected as *On* the Stage will immediately turn on and be modulated to 100%.

- STAGE SETTINGS -
Mode
>Ignition %
Mod Start %



Press to
show
setting

----- STAGE -----
IGNITION POINT
Value -> New Value



Turn to
adjust
value

----- STAGE -----
IGNITION POINT
Value -> New Value



Press to
select
new

- STAGE SETTINGS -
Mode
Ignition %
>Mod Start %



Press to
show
setting

----- STAGE -----
MODULATION START
Value -> New Value



Turn to
adjust
value

----- STAGE -----
MODULATION START
Value -> New Value



Press to
select
new

When does the lag stage turn OFF?

At 40% of the Previous Stage Mod Point
Or 2% Above the Ignition Point
(Whichever is higher)

Example:

Stage A - Lead
Ignition Point - 1%
Mod Start 75%

When does Stage B turn OFF?
At 40% of Stage A's Mod Point

$$75 \times (40/100) = 30$$

Stage B will turn off when A's
modulation reaches 30%

IGNITION POINT Default - 1%

When Can a Stage Begin Modulating?

- The Ignition Point is the percent modulation which must be attained before the unit can be activated.
- For most boilers, the Ignition Point should be set at 1%.
- Older units or atmospheric units may require the modulating fuel valve to be open from 20-50% before proper ignition can be attained. Check with the boiler manufacturer if you are in doubt about the minimum position of the fuel valve for ignition.

MODULATION START Default - 75%

When Does the Next Stage Turn On?

- The Modulation Start determines at what percent modulation of the current Stage the next Stage in the sequence will be activated.
- For example, if the Modulation Start for Stage A is set to 75%, then when Stage A reaches 75% modulation, Stage B (if Stage B is in Auto Mode and is not already on) will be brought on in low fire.
- When modulation is decreasing, the lag unit will remain on in low modulation, until the previous stage reaches 40% of its Modulation Start point, or 2% above the Ignition Point, whichever is higher.
- Using the same example, as the load decreased, Stage B would modulate down to low. Stage A would then modulate down to 30%. Only then would Stage B turn off.
- If the Lag Delay (see pg. 18) is set to anything other than 0, a Stage must always go up to 100% modulation before the next stage is activated. However, the Modulation Start should still be set correctly, because it will be valid when modulation is decreasing.
- The Modulation Start point will generally be set differently based on the Modulating Mode selected (see pg. 12).

Modulating Mode - NORMAL

- Lower settings of the modulation start point allow the next boiler in the sequence to be activated and warmed up, generally allowing more even set point control.
- Higher settings of the modulation start point prevent unnecessary Stages from being activated. Also, as most units run more efficiently at higher modulation, a higher setting can result in fuel savings.
- Some general guidelines follow:
 - Less than 50% - not recommended in the Normal mode.
 - 50%-70% - These lower settings might be used in an application which has wide load swings such as an industrial plant or a hospital. This allows an additional boiler to be brought on line before the previous boiler has begun to reach its capacity. The next boiler will now be available for fast, high demands.
 - 70-90% - This range is recommended for most applications. When there are several Stages of relatively equal capacity and all can be used to hold the load, this allows some degree of overlap, without activating unnecessary Stages.
 - 90-100% - Recommended when one Stage can almost always handle the load, and other Stages are mainly for backup.

Modulating Mode - PARALLEL

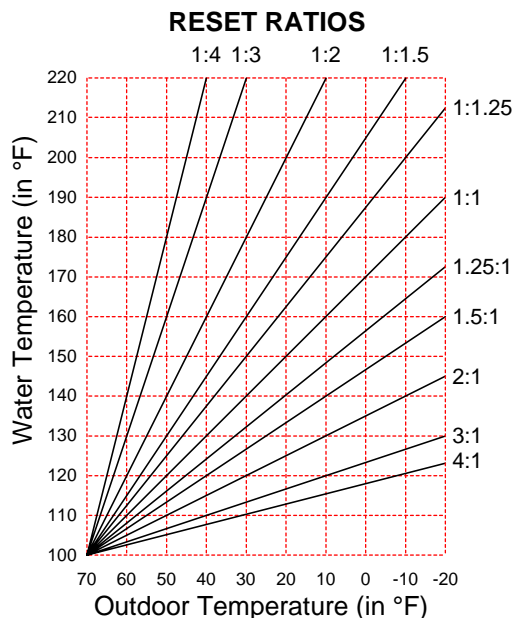
- The Modulation Point should be set to the value where the unit runs most efficiently.
- Contact the manufacturer to determine the appropriate setting.

COPY SETTINGS - STAGE A ONLY

- If all the active Stages will have the same Ignition Start Point and Modulation Point, they can be set for Stage A and then copied to the other Stages.
- It is still required to select the Mode for all other Stages. The Mode will not be copied.

IMPORTANT: The Mode MUST be set for each stage. The Copy Settings command will not set the Mode for Stages B, C, and D.

RESET SETTINGS



Temp			
<A>	B	C	D
OFF	OFF	OFF	OFF

--- SETTINGS ---			
>Set Point			
Gain			
Lead Stage			

ADJUST
PRESS TO SELECT
Press to
show
Settings

--- RESET RATIO ---			
1.00°OD = 1.25°Sys			
>1.00°OD = 1.00°Sys			
1.25°OD = 1.00°Sys			

ADJUST
PRESS TO SELECT
Press to
select
Set Point

--- RESET RATIO ---			
1.00°OD = 1.50°Sys			
>1.00°OD = 1.25°Sys			
1.00°OD = 1.00°Sys			

ADJUST
PRESS TO SELECT
Turn to
scroll

--- RESET RATIO ---			
1.00°OD = 1.50°Sys			
>1.00°OD = 1.25°Sys			
1.00°OD = 1.00°Sys			

ADJUST
PRESS TO SELECT
Press to
select
new

RESET RATIO

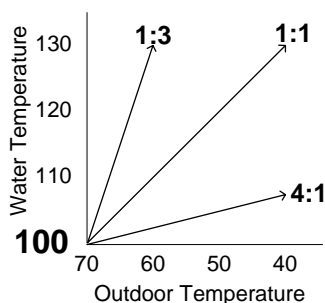
Default 1:1

- The Reset Ratio controls how much heat will be added based on outdoor temperature. The Reset Ratios are shown as Outdoor Temperature:Water Temperature.
- A 1:1 Reset Ratio signifies for each degree it gets colder outside, the Calculated water temperature will raise 1 degree.
- The other Reset Ratios are adjustable from 1:4 to 4:1.
- The Reset Ratio curves start at 70°F. At 70°F the Harmony will require 100°F water. Note that this is not the point where the Harmony will begin giving heat. That point is determined by the Outdoor Cutoff (next page). Also note that this starting point can be changed by adjusting the Offset (below).
- For new installations with standard baseboard heating, begin with a Reset Ratio of 1:1.
- For new installations with radiant heat, begin with a Reset Ratio curve of 2:1.
- Adjust the Reset Ratio value in cold weather. If the ambient indoor temperatures are cold in the cold weather, pick the next higher Reset Ratio (that is, go from 1:1 to 1:1.25). If the ambient building temperatures are warm in the cold weather, pick the next lower Reset Ratio (from 1:1 to 1.25:1).
- After adjusting the Reset Ratio curve, wait at least 24 hours before making another adjustment.
- To adjust the Reset Ratio, from the main display press the *ADJUST/SELECT* knob to obtain the *Settings* menu. Select *Set Point*. The Reset Ratio choices will now be shown.

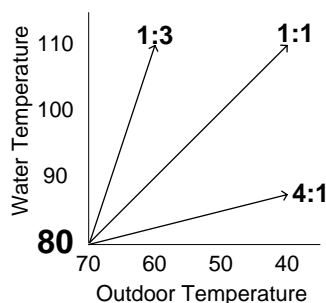
OFFSET

Default 0

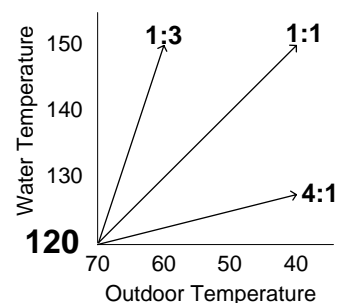
- The Offset value moves the starting point of the Reset Ratio curves (see charts below).
- Therefore, any change made to the Offset will immediately change the value of the Harmony Set Point water temperature by the same amount.
- For example, if the calculated Set Point water temperature were 150°F based on the specific outdoor temperature and Reset Ratio, then increasing the Offset from 0°F to 10°F would increase the Set Point water temperature to 160°F.



With a 0° Offset, the ratio curves begin at 100° Water Temperature.



With a -20° Offset, the ratio curves begin at 80° Water Temperature.



With a +20° Offset, the ratio curves begin at 120° Water Temperature.

RESET SETTINGS

--- RESET RATIO ---
1.00°OD = 1.50°Sys
>1.00°OD = 1.25°Sys
1.00°OD = 1.00°Sys



After
selecting
Ratio

----- OFFSET -----
Value



Turn to
adjust
Offset

----- OFFSET -----
Value -> New Value



Press to
select
new

----- OFFSET -----
Value -> New Value



After
selecting
Offset

-- OUTDOOR CUTOFF --
Value



Turn to
adjust
Cutoff

-- OUTDOOR CUTOFF --
Value -> New Value



Press to
select
new

-- OUTDOOR CUTOFF --
Value -> New Value



After
selecting
Cutoff

-MINIMUM WATER TEMP-
Value



Turn to
adjust
Minimum

-MINIMUM WATER TEMP-
Value -> New Value



Press to
select
new

- In a new installation, start with an Offset value of 0°.
- Adjust the Offset value in mild weather. If the ambient indoor temperatures are warm in the warm weather, decrease the Offset. If the ambient building temperatures are cold in the mild weather, increase the Offset.
- The rule of thumb for baseboard radiation is to change the Offset by 4° for every degree you wish to change the building temperatures. For radiant heat applications, change the Offset by 1° or 2° for every degree you wish to change the building temperature.
- The Offset can be set from -50 to 50°F.

OUTDOOR CUTOFF

Default 64°F

- The Outdoor Cutoff sets at what outdoor temperature the Harmony will begin heating.
- When the outdoor temperature is above the Outdoor Cutoff temperature, the Harmony will not activate stages. The Set Point water temperature will read *Off*.
- When the outdoor temperature drops to the Outdoor Cutoff temperature, the Harmony will activate the *SYS* relay, compute the Set Point water temperature, and sequence and modulate Stages to hold that Set Point.
- The Outdoor Cutoff has a built in 2°F differential. Once the *SYS* relay has been activated, it will remain activated until the outdoor temperature rises to 2°F above the Outdoor Cutoff temperature.
- If the building is too cold before the system starts, raise the Outdoor Cutoff temperature.
- The Outdoor Cutoff temperature can be set *Off*, *On*, or from 30 to 75°F.
- Setting the Outdoor Cutoff to *Off* may be used to disable the heating system during summer, during maintenance, or whenever no heat is required for a prolonged period of time regardless of outdoor temperature.
- Setting the Outdoor Cutoff to *On* means the heating system will run regardless of outdoor temperature. In mild weather, the lowest calculated Set Point will be determined by the Minimum Water Temperature (next).

MINIMUM WATER TEMPERATURE

Default 70°F

- Most boilers require a minimum temperature for the water returning from the system to the boiler.
- The Harmony controls the system temperature which is measured at the sensor location. Depending on the piping configuration and sensor location, the return temperature may vary significantly from that measured by the Harmony.
- Check with the manufacturer for the appropriate Minimum Water Temperature setting at the Harmony's sensor to meet the boiler's requirements.
- The Harmony will use the Minimum Water Temperature as the Set Point whenever it is higher than the calculated value determined by the outdoor temperature, Reset Ratio, and Offset.
- The Minimum Water Temperature can be set from 70 to 180°F.

IMPORTANT: If the Minimum Water Temperature is not set correctly, boiler life may be significantly shortened.

TROUBLESHOOTING

No Display, or Garbled Display

Check the 120VAC power input to the Harmony. Turn power to the Harmony off and back on.

TEMPERATURE INPUTS

Display shows OPN

Check the System Startup settings (pg. 11) to be sure the Harmony is configured correctly to read the temperature input. Then check a sensor is connected and the wires are continuous to the Harmony. Finally follow the procedure for Incorrect Temperature Display.

Display shows SHT

The Harmony sees a short across the sensor input terminals. Remove the wires from either the *SYSTEM TEMP* or *OUT TEMP* terminals (whichever is reading *SHT*). The display should change to read *OPN*. If it doesn't, the Harmony may be damaged.

Display shows an Incorrect Temperature Display

Remove the wires from either the *SYSTEM TEMP* or *OUT TEMP* terminals (whichever is reading incorrectly). The display should change to read *OPN*. If it doesn't, the Harmony may be damaged. Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the side chart. If it doesn't, the sensor may be damaged.

TEMPERATURE (in degrees F)	Value (in Ohms)
0	42683
10	31215
20	23089
25	19939
30	17264
35	14985
40	13040
45	11374
50	9944
55	8714
60	7653
70	5941
80	4649
90	3667
100	2914
110	2332
120	1879
130	1524
140	1243
150	1021
160	842
170	699
180	583
190	489
200	412

STAGE OUTPUTS

When the unit's Mode is set to ON, the unit does not come on

To set the Mode to ON, see pg. 22. Remove any wires attached to the Harmony output. Check for continuity across the stage's N.O. contacts. If there is continuity, the Harmony output is working correctly. Check the wiring and the unit being energized to determine why it is not operating.

Red stage light is lit, but the unit is not on

The Harmony is calling for this unit to be on. Follow the procedure above.

Red stage light is not lit, but the unit is on

The Harmony is not calling for this unit to be active. Remove any wires attached to the Harmony output. Check for continuity across the N.O. contacts. If there is no continuity, the Harmony output is working correctly. Check the unit for any other operating controls which may be causing it to energize.

SYSTEM OUTPUT

Output is required but the SYSTEM component does not come on

Check the display to see if the temperature is above the Set Point or if the Outdoor Cutoff is active.

Red SYSTEM light is lit, but the SYSTEM component is not on

The Harmony is calling for the unit. Check for continuity across the N.O. *SYS* contacts. If there is continuity, the Harmony is working correctly. Check the wiring and the component being energized to determine why it is not operating.

Red stage light is not lit, but the SYSTEM component is on

The Harmony is not calling for the component to run. Remove any wires attached to the Harmony's *SYS* terminals. Check the N.O. terminals are open. If they are, check the unit for any other operating controls which may be causing it to energize.

APPENDIX

SYSTEM STARTUP MENU

- On the initial start-up, the Harmony will automatically step through the System Startup. After that, it must be reached through the menu system.
- **DO NOT** make changes to the System Startup unless you have carefully checked the installation. An incorrect setting in the System Startup menus may cause the Harmony to be unable to read the sensor, unable to output, or generally just not operate the system.
- **DO NOT** make changes to the System Startup unless you have copied all other settings and are prepared to restore them. Some changes in the System Startup may cause Operating, Stage, and System settings to revert to their default values.
- From the main display, press the *ADJUST/SELECT* knob and release it to reach the *Settings* display.
- Scroll down to *<System Startup>* and select it.
- The screen will show *System Startup* and *Select to continue*.
- Read and follow the prompts until *Sensor Type* is displayed.
- Follow the directions starting on pg. 11 to set each item correctly.

WARNING: DO NOT make changes to the System Startup Menu without first carefully reading the preceding section. Making changes to the System Startup may cause the Harmony to no longer control the system or to control the system erratically.

EXTERNAL SET POINT (4-20MA EMS-CONTROL) RANGE

Set-Up

- The 4-20mA option is not available when using the Reset Function. It is only available for systems where the Sensor Type is Temperature (see pg. 11).
- The 4-20mA range adjustment can only be reached through the System Startup menu system (see above).
- In the *EMS-INPUT* menu, press the *ADJUST/SELECT* knob to select *EMS-Control*.
- The next screen is *EMS 4ma Setpoint*. This screen allows you to set the desired Harmony Set Point when the EMS input is 4mA. The temperature range of the selection is from 100 to 240°F. Rotate the *ADJUST/SELECT* knob until the desired value is selected and then press the knob.
- The next screen is *EMS 20ma Setpoint*. This screen allows you to set the desired Harmony Set Point when the EMS input is 20mA. The range of the selection is from 100 to 240°F. Rotate the *ADJUST/SELECT* knob until the desired value is selected and then press the knob.

Operation

- The Set Point will vary linearly with the 4-20mA signal from the EMS signal, as shown by the example set points in the chart on the right.
- Either 4 or 20mA can be the bottom (or top) of the Set Point range.
- If the signal from the EMS is not connected, is less than 3.9mA, or is greater than 20.1mA, the Harmony Set Point will flash *OFF* and no stages will be active. This feature can be used as an external shut-down.

4-20mA Temperature Example

4-20ma Input	MOD-4 Set Point
4ma (adjustable setting)	100°F
8ma	125°F
12ma	150°F
16ma	175°F
20ma (adjustable setting)	200°F

IMPORTANT: If the Harmony is not wired to the EMS, or if the signal is less than 3.9mA or greater than 20.1mA, the display will flash *OFF*. This indicates the input signal from the EMS is not properly wired (see pg. 5) or the EMS system may not be correctly configured.

MOVING AROUND THE STAGES MENUS

- Pressing the *STAGE* button allows you to automatically scroll through the *Stage A, B, C, and D Settings*.
- Pressing the *NEXT* button automatically moves you through the adjustments for each stage. For example, after viewing the *Ignition Point*, pressing the *NEXT* button will move you to the *Modulation Start*.
- Pressing the *NEXT* button does **NOT** save the setting. To save a new setting, you **MUST** press the *ADJUST/SELECT* knob.
- Pressing the *PREVIOUS* button automatically returns you to the previous adjustment for a Stage without having to return to the *Stage Settings* menu.

MANUAL CONVENTIONS

- Items on the panel (knobs, buttons, terminals) are referred to all in upper case letters and italics. For example, the power terminals are referred to as: *LINE* and *NEUTRAL*.
- Items on the display are referred to with an upper case first letter and italics. For example, the set-up screen for the sensor type is referred to as: *Sensor Type*.
- The names of settings are referred to with an upper case first letter. They will not be italicized unless specifically referring to it is when it is being displayed.

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HARMONY SPECIFICATIONS

Input Voltage	120VAC
Power Consumption	30VA
Lead Stage Rotation	
Manual	
First On/First Off	
Automatically	Every hour to every 7 days
Output Types	4-20mA, or
Voltage.....	0-5V, 0-10V, 1-5V, or 2-10V
Stage Modes	Off, Auto, On, Standby, Manual
Output Contacts	5 SPST
Output Rating	6A resistive, 1/3HP
Operating Ambient Temperature	20 to 120°F
Enclosure	NEMA -1
Dimensions	12-3/4" x 12-3/4" x 4-5/8"
Temperature Accuracy	± 1°F (1°C)
Temperature Display	Field select °F or °C
Temperature Range	-30 to 250°F (-35 to 120°C)
Ignition Start Point	1 to 50%
Modulation Start Point	50 to 100%
Operating Mode	Normal or Process
Purge Delay	1.0 to 10.0 minutes
Lag Stage Delay	0 to 60 minutes
System Run On Delay	0 to 30 minutes
Standby Time	0 to 60 minutes
Setback	0 to 75°F (0 to 42°C)
Last Stage Hold	0 to 30°F (0 to 30°C)
Shutdown Input	Dry Contact Only
System Prove Input	Dry Contact Only
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